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REPORT

CD NO.

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| COUNTRY | USSR | DATE OF INFORMATION | 1948 |
| SUBJECT | Scientific - Geophysics, meteorology | DATE DIST. | 18 Sep 1951 |
| HOW PUBLISHED | Book | | |
| WHERE PUBLISHED | Moscow | NO. OF PAGES | 9 |
| DATE PUBLISHED | 1948 | SUPPLEMENT TO REPORT NO. | |
| LANGUAGE | Russian | | |



THIS IS UNEVALUATED INFORMATION

SOURCE Dinamicheskaya Meteorologiya, Gostekhizdat, (LC QC 880.B37), 704 pp.

# INFORMATION FROM THE BOOK "DYNAMIC METEOROLOGY" BY V. A. BELINSKIY

/The following report gives the author's Foreword and the Table of Contents of Dinamicheskaya Meteorologiya./

## FOREWORD

This book is a text on dynamic meteorology, written primarily for the meteorological and military faculties of hydrometeorological institutes. It is based on lectures on dynamic meteorology, a subject the author has taught since 1938 in the Moscow Hydrometeorological Institute and later in the Leningrad Hydrometeorological Institute, in Leningrad University, and in others.

In the curriculum of higher hydrometeorological schools, dynamic meteorology is taught in the third and fourth courses, after the students have taken higher mathematics, physics, theoretical mechanics, and general meteorology. The first half of the dynamic meteorology course is taken concurrently with a course in hydrodynamics, and the second half is taken concurrently with a course in synoptic meteorology. Therefore, in setting up the course in dynamic meteorology the author has assumed that the student has competence in higher mathematics, physics, mechanics, hydrodynamics, and general meteorology at the level of courses in higher hydrometeorological schools.

There are only a few books on dynamic meteorology and one of these can be used as a textbook for higher hydrometeorological schools.

The two-volume monograph written by Soviet authors and edited by N. Ye. Kochin and B. I. Izvekov (1935 - 1938) is interesting in many respects, but the excessive length of the book and some bias in the selection of material prevent its use as a text. In addition, the book is out of date in parts, since it does not contain the interesting results recently obtained by Soviet meteorologists.



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Of all the foreign books, Haurwitz's book, published in 1941, was closest to the course which the author has taught since 1938 in the Moscow Hydrometeorological Institute and differs from the rest in its orderly composition and clear presentation. However, this book also has two major defects, i.e., it was written for readers completely unacquainted with meteorology and therefore too much elementary material is included; and, more important, the book ignores the results obtained by Soviet authors. Frequently, a superficial solution of a given problem obtained by German or English authors is cited, while a much more complete solution of the same problem obtained by Soviet authors is completely ignored. This defect is also found in all other foreign books (e.g., J. Holmboe, G. E. Forsythe, and W. Gustin's Dynamic Meteorology, published in 1946).

In drawing up his course, the author was confronted with the following tasks:

1. To give a complete presentation of the tasks and capabilities of contemporary dynamic meteorology, particularly the task of forecasting weather, the main practical problem of dynamic meteorology. To draw up on the strictest possible basis a closed system of weather equations, and to analyze these equations, and to analyze these equations and show their degree of applicability to weather forecasting.

2. To state, as completely as possible, the theory of elementary meteorological processes which will serve as a basis for subsequent courses in synoptic meteorology.

3. To investigate some important practical applications, particularly forecasting applications, resulting from the theory of elementary meteorological processes.

The book is divided into 21 chapters. Although, comparatively elementary problems are discussed in some chapters, these chapters are quite necessary for clear understanding of the more complex material presented, as well as of the practical conclusions which are widely used by meteorologists in operational and scientific research.

Even a superficial knowledge of this book will convince the student of the enormous contribution to dynamic meteorology made by Soviet scientists and particularly by the Soviet school of theoretical meteorologists founded by A. A. Fridman. Fridman's scientific interests were exceptionally wide in scope, but he left the deepest imprint in meteorology by creating the Soviet school of theoretical meteorologists, the distinguishing feature of this school being its application of all the modern accomplishments of hydromechanics and thermodynamics to advance meteorology.

Only the more important of the Soviet works which were used in this book are listed. Chapter VIII contains Ye. S. Kuznetsov's detailed and strict derivation of a closed system of equations of hydromechanics, thermodynamics, and the theory of radiation. At the end of the same chapter, the student is introduced to the highly promising ideas of Fridman and Keller in the study of turbulence. These ideas found expression in the so-called Fridman-Keller equations.

Chapter IX presents two important results obtained by Soviet scientists which permitted simplification of the highly complex equations of motion. It also gives the detailed tables drawn up by Fridman (jointly with Hesselberg) characterizing the order of values of meteorological elements and their derivatives, as well as the results obtained by Academician N. Ye. Kochin, who applied the methods of the boundary layer to atmospheric movements.

Chapter XV gives an interesting and important result relating to the special structure of turbulence. This result is known in literature as the "Two-Thirds Law" of Kolmogorov and Obukhov.

Practically all of Chapter XVI, on the variation of wind with height in a turbulent atmosphere, was based on Soviet studies. Likewise, a substantial part of Chapter XVIII on the general circulation of the atmosphere was based on Soviet works. Specifically, this chapter includes: the work of Academician V. V. Shuleykin, who clarified the role of continents and oceans in the general circulation mechanism; the mathematical theory of general circulation developed by Kochin; and Ye. N. Blinova's hydrodynamic theory of pressure waves and centers of action of the atmosphere.

The problem of small oscillations of a surface of separation and loss of its stability which was studied by Kochin is investigated in detail in Chapter XIX.

Chapters XX and XXI are given entirely to the results recently obtained by Soviet scientists in integrating weather equations. These results are especially interesting and promising in that they relate to weather forecasting.

Many years of experiments have shown that the main difficulty encountered by the student is in relating the mathematical tool used with the physical essence of phenomena. The author has, therefore, constantly tried to focus the student's attention on the physical side of the phenomena. In some paragraphs, the author was forced to retain in the presentation of works of Soviet researchers a complex mathematical method, which is not included in the mathematics course of higher hydrometeorological schools, without giving a detailed explanation of the method. However, this was unavoidable, since the results had to be included and prolonged excursions into the field of higher mathematics would have burdened the book with superfluous material. The student who is interested in these particular problems can always find the method in a mathematics text.

The terminology used in the book deserves special mention. Often, a term will have one meaning in hydrodynamics and another in meteorology, e.g., gradient, convection, circulation, etc. However, the author did not consider it feasible to introduce new terms in these cases; the words are used for the most part in their meteorological meaning, on the assumption that the readers will be primarily meteorologists rather than specialists in hydrodynamics.

A list of the basic literature used in the compilation of this text and recommended to the student for more thorough study of the problem is appended.

The author would like to thank his teachers, Academician V. V. Shuleykin, I. A. Kibel', Corresponding Member Academy of Sciences USSR; and Professor Ye. S. Kuznetsov; his colleagues at the institute, Professors S. P. Khromov and A. Kh. Khrgian; and also his students L. Matveyev, S. Titov, P. Smirnov, and I. Slavin, who read the manuscript and gave many valuable suggestions for improving it. Special thanks are extended to Sh. N. Gofsteyn for his assistance in the writing of the book.

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